

REMARKS

Claims 1, 21-22 and 98 have been amended. Claims 1-31 and 99 remain pending. Applicants reserve the right to pursue the original claims and other claims in this and other applications. Applicants respectfully request reconsideration of the above-referenced application in light of the amendments and following remarks.

Claim 99 stands rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The rejection is respectfully traversed. The Office Action asserts that the claim language reciting the top electrode comprising 'a bottom and top conducting layer' is not described in the original specification. Applicants respectfully disagree; but, nonetheless, to expedite prosecution, claim 99 has been amended to omit the offending claim language. Consequently, the § 112, first paragraph rejection should now be withdrawn.

Claims 21-22 stand objected to because of informalities. Claims 21-22 have been amended as instructed by the Office Action. Consequently, the objection should now be withdrawn.

Claims 1-3, 7-16, 18-25 and 29-31 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,338,996 ("Iizuka"). The rejection is respectfully traversed.

The cited reference fails to teach the subject matter of amended independent claim 1. Specifically, Iizuka does not disclose a capacitor comprising, *inter alia*, "a bottom conducting layer . . . an *annealed dielectric layer*, wherein said annealed dielectric layer is annealed with a *first annealing process* . . . and a top electrode consisting of a single oxidized *gas annealed top conducting layer* formed over said *annealed dielectric*

layer, wherein said annealed top conducting layer is annealed with a *second annealing process*," as recited in claim 1 (emphasis added).

In FIG. 1, Iizuka discloses a capacitor 20 consisting of a lower electrode 28, a capacitance film 30, and an upper electrode 32. In the first embodiment, Iizuka teaches that "[a]fter forming the high dielectric thin film capacitor, [an] anneal is performed . . . in a nitrogen atmosphere." (Col. 4, ll. 28-31) (emphasis added). In the second embodiment, Iizuka discloses, again, that "[a]fter the high dielectric thin film capacitor is formed, [an] anneal is performed in a gas mixture of oxygen (5% or below) and nitrogen." (Col. 4, ll. 55-59) (emphasis added).

In both embodiments, Iizuka teaches that in the nitrogen atmosphere-containing *and* the oxygen plus nitrogen atmosphere-containing anneals, *both* anneals are conducted *after* the high dielectric thin film capacitor is formed. Iizuka does *not* disclose an *annealed* dielectric layer *and* an annealed top conducting layer. Iizuka conducts a *single* anneal "*after* the high dielectric thin film capacitor is formed." (Col. 4, ll. 54-55) (emphasis added). Iizuka does not disclose a structure that undergoes two separate anneal processes.

Applicants' claimed invention "improves the dielectric property of the dielectric layer 36 by *adding* an oxidizing gas anneal (*second anneal*) which fills the oxygen voids created in the dielectric layer 36 after the top conducting layer 38 is deposited." (Applicants' specification, p.8, ll. 8-10) (emphasis added). The second anneal fills oxygen voids. Since Iizuka does not teach a second anneal process, these oxygen voids, a structural component, would still be present in the dielectric layer. The final structure in Iizuka is different from Applicants' claimed structure as a result of using only a single anneal process. As such, Iizuka does *not* disclose "*an annealed dielectric layer . . . and a top electrode consisting of a single oxidized gas annealed top*

conducting layer," as recited in claim 1 (emphasis added).

Claims 2-3, 7-16, 18-25 and 29-31 depend from claim 1 and should be similarly allowable along with claim 1 for at least the reasons provided above regarding claim 1, and on their own merits.

For example, Iizuka does *not* teach that the "dielectric layer is Tantalum Oxide and is amorphous or crystalline," as recited in dependent claim 14. The Office Action asserts that Iizuka's Col. 4, ll. 55-63 teaches the claimed structure. Applicants respectfully disagree.

Iizuka discloses that "[a]fter the high dielectric thin film capacitor is formed, [an] anneal is performed in a gas mixture of oxygen (5% or below) and nitrogen." (Col. 4, ll. 55-59) (emphasis added). Consequently, Iizuka's Col. 4, ll. 55-63 does not teach, much less suggest a dielectric layer that is either Tantalum Oxide, amorphous, or crystalline. This fact is underscored upon reviewing Iizuka's complete disclosure.

Iizuka discloses that "[t]he capacitance insulation film 30 is formed by a high dielectric film such as a (Ba, Sr)TiO₃ film (BST)." (Col. 3, ll. 40-42). There is no teaching or suggestion that the "dielectric layer is Tantalum Oxide and is amorphous or crystalline," as recited in dependent claim 14. To establish *prima facie* obviousness of a claimed invention, *all* the claim limitations must be taught or suggested *by the prior art.*" M.P.E.P. § 2143.03. In this case, there is no teaching or suggestion to substitute the dielectric materials in Iizuka since the reference explicitly discloses using BST for the dielectric film (Col. 6, ll. 37-40). These are additional reasons for the allowance of dependent claim 14.

Claims 4-5 and 17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka in view of U.S. Patent No. 5,452,178 ("Emesh"). The rejection is respectfully traversed.

Claims 4-5 and 17 depend from claim 1 and should be similarly allowable with claim 1 for at least the reasons provided above with regard to claim 1, and on their own merits. Specifically, Iizuka does not disclose a capacitor comprising, *inter alia*, "a bottom conducting layer . . . an *annealed dielectric layer*, wherein said annealed dielectric layer is annealed with a *first annealing process* . . . and a top electrode consisting of a single oxidized *gas annealed top conducting layer* formed over said *annealed dielectric layer*, wherein said annealed top conducting layer is annealed with a *second annealing process*," as recited in claim 1 (emphasis added). Iizuka, in both embodiments, discloses only a *single anneal* conducted *after* the high dielectric thin film capacitor is formed. Iizuka does not teach or suggest a structure with a dielectric layer annealed with a first annealing process *and* a top conducting layer annealed with a second annealing process.

With respect to claims 4, 5 and 17, the Office Action acknowledges that Iizuka does not disclose a bottom conducting layer that is a metal alloy or conducting metal oxide, or that the top conducting layer is a conducting metal oxide (p. 5). In view of Iizuka's shortcomings, the Office Action relies on Emesh for this disclosure and summarily concludes that it would be obvious to substitute Emesh's electrode materials with Iizuka's to provide alternative materials to make the electrodes (p. 6). Applicants respectfully disagree.

Iizuka teaches away from the proposed combination. Iizuka discloses a "semiconductor device having a capacitor formed by a high dielectric insulation film and a *noble metal* upper electrode which are successively layered on a *noble metal* lower

electrode.” (Col. 2, ll. 28-31 and Col. 2, ll. 38-40) (emphasis added). Iizuka teaches that *both* electrodes in the capacitor should consist of a *noble metal*.

These facts are underscored by Iizuka’s disclosure that “[t]he lower electrode 28 *and* the upper electrode 28 are formed by a *noble metal film* such as Ru, Ir, and Pt.” (Col. 3, ll. 38-40) (emphasis added). Consequently, there is no motivation to use Emesh’s metal alloy or conducting metal oxide, for either the upper or lower electrodes in Iizuka, since Iizuka teaches away from the proposed combination.

As such, the cited references are not properly combinable, and still would not disclose or suggest that the “bottom conducting layer is formed of a metal alloy,” as recited in dependent claim 4, or that “the bottom conducting layer is formed of a conducting metal oxide,” as recited in claim 5, or that “the top conducting layer is formed of a conducting metal oxide,” as recited in claim 17.

Claims 6 and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka in view of U.S. Patent No. 6,303,426 (“Alers”). The rejection is respectfully traversed.

Claims 6 and 14 depend from claim 1 and should be similarly allowable with claim 1 for at least the reasons provided above with regard to claim 1, and on their own merits. Specifically, Iizuka does not disclose a capacitor comprising, *inter alia*, “a bottom conducting layer . . . an *annealed dielectric layer*, wherein said annealed dielectric layer is annealed with a *first annealing process* . . . and a top electrode consisting of a single oxidized *gas annealed top conducting layer* formed over said *annealed* dielectric layer, wherein said annealed top conducting layer is annealed with a *second annealing process*,” as recited in claim 1 (emphasis added). Iizuka does not teach or suggest a structure with a dielectric layer annealed with a first annealing process *and* a top

conducting layer annealed with a second annealing process.

With respect to claims 6 and 14, the Office Action acknowledges that Iizuka does not disclose a bottom conducting layer that is a metal nitride, or that the dielectric layer is formed of TaO and is crystalline or amorphous (p. 6). In view of Iizuka's shortcomings, the Office Action relies on Alers for this disclosure and summarily concludes that it would be obvious to substitute Alers' materials with Iizuka's to provide alternative materials to make an electrode or dielectric layer (pp. 6-7). Applicants respectfully disagree.

As indicated above, Iizuka teaches that *both* electrodes in the capacitor should consist of a *noble metal*. Consequently, there is no motivation to combine Iizuka and Alers with regard to electrode materials since Iizuka teaches away from any other material but noble metals for the electrode. The references do not teach or suggest that the "bottom conducting layer is formed of a metal nitride," as recited in dependent claim 6.

In addition, there is no teaching or suggestion that the "dielectric layer is Tantalum Oxide and is amorphous or crystalline," as recited in dependent claim 14. As indicated above, there is no teaching or suggestion to substitute the dielectric materials in Iizuka since the reference explicitly discloses using BST for the dielectric film (Col. 6, ll. 37-40). These are additional reasons for the allowance of dependent claims 6 and 14.

Claims 26-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka in view of U.S. Patent No. 6,475,854 ("Narwankar"). The rejection is respectfully traversed.

Claims 26-27 depend from claim 1 and should be similarly allowable with claim 1 for at least the reasons provided above with regard to claim 1, and on their own merits. Specifically, Iizuka does not disclose a capacitor comprising, *inter alia*, "a bottom conducting layer . . . an *annealed dielectric layer*, wherein said annealed dielectric layer is annealed with a *first annealing process* . . . and a top electrode consisting of a single oxidized *gas annealed top conducting layer* formed over said *annealed dielectric layer*, wherein said annealed top conducting layer is annealed with a *second annealing process*," as recited in claim 1 (emphasis added). Iizuka does not teach or suggest a structure with a dielectric layer annealed with a first annealing process *and* a top conducting layer annealed with a second annealing process.

Narwankar is relied upon for disclosing plasma enhanced annealing, remote plasma enhanced annealing, or ultraviolet light enhanced annealing, and adds nothing to rectify the deficiencies associated with Iizuka. Namely, Iizuka fails to disclose a structure with a dielectric layer annealed with a first annealing process *and* a top conducting layer annealed with a second annealing process.

Claim 28 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka in view of U.S. Patent No. 6,387,802 ("Marsh"). The rejection is respectfully traversed.

Claim 28 depends from claim 1 and should be similarly allowable with claim 1 for at least the reasons provided above with regard to claim 1, and on its own merits. Specifically, Iizuka does not disclose a capacitor comprising, *inter alia*, "a bottom conducting layer . . . an *annealed dielectric layer*, wherein said annealed dielectric layer is annealed with a *first annealing process* . . . and a top electrode consisting of a single oxidized *gas annealed top conducting layer* formed over said *annealed dielectric layer*, wherein said annealed top conducting layer is annealed with a *second annealing process*,"

as recited in claim 1 (emphasis added). Iizuka does not teach or suggest a structure with a dielectric layer annealed with a first annealing process *and* a top conducting layer annealed with a second annealing process.

The Office Action acknowledges that Iizuka does not disclose using ultraviolet light enhanced annealing. In view of Iizuka's shortcomings, the Office Action relies on Marsh for this disclosure (p. 8). Marsh, however, adds nothing to rectify the deficiencies associated with Iizuka. Namely, Iizuka fails to disclose a structure with a dielectric layer annealed with a first annealing process *and* a top conducting layer annealed with a second annealing process.

Claim 99 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka in view of Emesh. The rejection is respectfully traversed.

The cited references fail to teach or suggest the subject matter of amended independent claim 99. Specifically, Iizuka does not disclose a capacitor comprising, *inter alia*, "a bottom electrode; *an annealed dielectric layer* that has been annealed with a *first oxidizing gas anneal process . . .* and an upper electrode comprising *a top conducting layer which is an oxidized gas annealed layer* formed over said annealed dielectric layer that has been annealed with a *secondt oxidizing gas anneal process*," as recited in claim 99 (emphasis added).

As discussed above, at best, Iizuka discloses a *single* oxidizing gas anneal which is conducted *after* the high dielectric thin capacitor is formed. Iizuka does not disclose or suggest a structure with a dielectric layer annealed with a first annealing process *and* a top conducting layer annealed with a second annealing process. Emesh is relied upon for disclosing an a top electrode comprising multiple layers and adds nothing to rectify the deficiencies associated with Iizuka.

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In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to review and pass this application to issue.

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Respectfully submitted,

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